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THE VALUE OF THE WING SCALES AS AN AID TO THE TAXONOMY OF ADULT *ANOPHELES MACULIPENNIS*

BY

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AND

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HACKETT (1), in his book *Malaria in Europe*, states that when the theory of the *A. maculipennis* races was discussed at the Second International Malaria Congress in Algiers in 1930, it aroused considerable discussion, criticism and opposition. He writes :—

> "It was a weakness of our contention that by no physical sign could one of these races be told from the other (meaning the adult insect). It left the whole complicated situation in the air, at least in the opinion of systematic entomologists, who perforce ignore anything which they cannot label and put in a museum. Six years previous to this meeting (1924) Falleroni had observed that while there were several different types of eggs of *A. maculipennis*, the same female always laid the same kind of egg."

At the same time Van Thiel (2) was working on the *A. maculipennis* problem by endeavouring to find a means of identification based on wing measurements. Seven years after Falleroni's discovery, Hackett (3), Missiroli and Martini and Hackett (4) and Missiroli made a careful study of the bionomics of *A. maculipennis* based on the kind of eggs laid. As the result of this original work the malaria puzzle in Europe, at least to some extent, became less of a puzzle when it became known that within the species *A. maculipennis* there were several forms each having its own peculiar habits. In 1935 Shute (5) showed that the males of at least five races, if *A. elutus* be included, could be identified by the shape of the external spines of the harpago. The cross-breeding experiments of Swellengrebel and de Buck (6) must also be mentioned because they seem to us to be of great significance when the question of variety or species is under consideration. Despite these three fundamental findings—(*a*) the pattern of the eggs, (*b*) the shape of the external spines of the harpago, and (*c*) failure to cross-breed successfully—there was a reluctance by the systematic entomologists to raise the so-called races or varieties to specific rank. Apparently what was required was some distinguishable markings whereby the adults of the varieties could be recognised. In this paper we propose to describe our findings whereby the adults, both male and female, can be classified. We believe and hope that this will justify raising at least some of the *A. macupilennis* varieties to specific rank.

In 1937, one of us (E. U.), working in an endemic malarious area in Northern Rumania, found that the shape of the plume and plume-like scales of the wings varied in shape and size according to the variety.

Before describing our findings it may be worth while describing the scaling of the wing. This is taken verbatim from Christopher's (7) book, *Fauna of British India.*

"The general arrangement of scales on the wing-veins in the Anophelini shows the arrangements of scales on a convex vein as seen from above (fig. 1, pl. 19). The costa (up to subcostal junction) and veins 1, 3, 5 and 6 are *direct* or *convex* veins, and the subcosta and veins 2 and 4 *reverse* or *concave* veins. On the upper surface of direct veins and the lower surface of reverse veins the scales are normally somewhat bat-shaped, often truncated and with parallel striations ; they have short, bent stalks and lie flat and parallel to the vein (squame scales). Those in the middle of the vein (median squames) are usually shorter and often narrower than those projecting laterally over the wing membrane (*lateral squames*). On the lower surface of direct veins and on the upper surface of reverse veins the scales are longer, usually narrower and more pointed, with less numerous and less markedly parallel striations ; their stalks are not sharply bent and the scales project at an angle from the vein (plume scales). As the apex of the wing is approached, the scales tend to elongate and to lose their distinctive characters, and the same applies to the greater part of the wing in some species.

"The broadest scales, as a rule, are on the inner third of the costa, subcosta, and vein 1. They are also about equally broad on the base of the stem of vein 5, but are distinctly narrower and usually less truncated on the remaining veins. The number of striations shown by the scales on the inner third of the costa, subcosta, or vein 1, is the *maximum striation* for the species.

"On the wing border posteriorly are the special *fringe scales*, and at their bases are small, obliquely set scales (*border scales*), which may be dark, or light, or absent more or less extensively towards the base of the wing, according to the species."

Material on which our studies are based.

1. *Anopheles maculipennis* var. *maculipennis* Meigen.
   Collected in nature from villages around Jassy, Northern Rumania.
2. *Anopheles maculipennis* var. *messeae* Falleroni.
   Collected in nature from villages in northern Rumania and in the south of England.
3. *Anopheles maculipennis* var. *atroparvus* van Thiel.
   Collected in nature from villages in northern Rumania, from south-east England, and from a strain which has been maintained in an insectarium over a period of eleven years.
4. *Anopheles maculipennis* var. *labranchiae* Falleroni.
   Collected by Professor Senevet, Algiers, and by Professor Missiroli, southern Italy.
5. *Anopheles elutus* Edwards.
   Collected in nature from Constanza, Rumania, and material in the Museum of the London School of Tropical Medicine collected in Albania.

In order to obtain uniform results our description of the scales and the photo-micrographs accompanying this article are from material which is prepared as follows :—

The wing of the mosquito is detached, placed in the centre of an ordinary glass slide, and one or two drops of zylol dropped on to the wing. After a few seconds a small drop of very thin Canada balsam is dropped

on to the wing and a cover-slip applied. This ensures that most of the scales lie quite flat, as can be seen in the photo-micrographs, even when an oil immersion lens is used.

Although, as Christophers (6) points out, the scales tend to elongate and to lose their distinctive characters as the apex of the wing is approached, we found it convenient to concentrate on the scales of the second longitudinal (reverse) vein. For purposes of identification we found that the low power of the microscope ($\frac{2}{3}$ inch lens and × 6 ocular) was sufficient, but all measurements were made with the $\frac{1}{6}$-inch lens and a × 6 ocular.

It was found that specimens of the same variety varied considerably in size and therefore it was considered essential that both the length and the width of the scales should be measured in order to obtain an index : $\frac{\text{length}}{\text{width}} = \text{index}$.

TABLE 1—INDEX OF SCALES

	m. maculipennis		*messeae*		*atroparvus*	
	No. of measurements	Index	No. of measurements	Index	No. of measurements	Index
Rumania :						
Collected in nature ...	253	8,31	224	9,12	405	11,72
Bred in laboratory ...	266	8,34	392	9,33	502	11,00
England :						
Collected in nature ...	—	—	316	9,50	442	11,08
Bred in laboratory ...	—	—	200	9,18	802	11,05
Total	519	8,33	1,132	9,29	2,151	11,21

The mean length and width of the total number of scales examined in each variety is—

atroparvus Length 118·650, width 10·535 μ.
messeae Length 116·410, width 12·775 μ.
m. maculipennis Length 113·330, width 13·615 μ.

We made it a practice to examine and measure ten scales of each wing. From these results it will be seen that in *atroparvus* the scales are narrow, while in *messeae* and *m. maculipennis* they are wide ; in *m. maculipennis* they are wider than in *messeae*.

The shape of the scales.

atroparvus The scales are slender and taper gradually towards the tip.

messeae The scales are wider than in *atroparvus* (lanceolate) and taper acutely towards the tip.

m. maculipennis The scales are wider than in *messeae* and they taper less acutely towards the tip than they do in *messeae* but more acutely than in *atroparvus*.

elutus The scales are widest in the centre and taper gradually towards the tip, but more acutely than in *atroparvus*.

For purposes of identification it is not necessary to resort to measurements, and this applies whether the specimens are large or small. For example, because of the very cool summer in England last year (1946) *maculipennis* have been exceptionally large and, although the scales on the wings of these have been proportionately large, yet the mean index has been the same as for specimens smaller than the normal bred out from eggs of the same strain under laboratory conditions. Specimens of *atroparvus* collected from a coastal region in the south of England had a wing length of 5·61 mm., while specimens of the same strain which have been breeding uninterruptedly in the laboratory over a period of eleven years had a wing length of 3·57 mm. Despite this difference in the size of the wings, the index of the two groups was the same. It is generally considered that *atroparvus* is smaller than *maculipennis* and *messeae*, but, as already stated, very large specimens of *atroparvus* were collected last year and in many instances they were larger than some *messeae* which were collected inland. Some specimens of *atroparvus* were found to have a wing length of 5·50 mm. against some *messeae* with a wing length of 4·89 mm. Based on the shape of the wing scales, no difficulty was experienced in identifying the varieties.

We would add that in all our studies, identifications of the variety based on the shape of the wing scales were confirmed by the eggs. Through the kindness of Professor Buxton we examined a collection presented by the late Dr. de Buck of Holland. They were labelled "long wings" and "short wings." As is well known, the Dutch workers preferred the term "short wing" for *atroparvus* and "long wing" for *messeae*. Based on a study of the wing scales, we found that of 20 specimens examined and labelled "long wing," 17 were typical *messeae* and 3 were doubtful and seemed to us to be large specimens of *atroparvus*. From 25 labelled "short wings," 23 had wing scales typical for *atroparvus*. Two had scales typical of *messeae* and seemed to us to be small specimens of this variety.

From these studies of the wing scales we have formulated the following key :—

Key 1.

1. Squame scales on the bifurcation of the second and fourth (reverse) vein longer, the accumulation of squame and plume scales making definite dark spots 3, 4, 5
2. Squame scales on the bifurcation of the second and fourth (reverse) vein shorter, the accumulation of squame and plume scales making less conspicuous dark spots 6
3. Plume scales slender and tapering gradually towards the tip *atroparvus*
4. Plume scales wider (lanceolate), and taper acutely towards the tip *messeae*
5. Plume scales wider than 4, lanceolate and taper less acutely than 4 towards the tip . . . . . *maculipennis*
6. Plume scales are widest in the centre and taper gradually towards the tip . . . . . *elutus*

In the present state of our knowledge it is not yet possible to give a key which will, with any degree of certainty, enable identification of the larvae of all the varieties in the *A. maculipennis* group, excluding *elutus*. However, we have now reached the state when it is possible to identify not only the egg but the male and female adult.

We, therefore, propose to include the key characters of the egg and the male adult in this paper, not because they represent new or original findings, but because it may serve a useful purpose.

THE EGGS (AFTER HACKETT AND MISSIROLI, 1945).

	Egg marking (upper surface)	Egg Float (as seen from above)
Barred eggs :		
messeae	Dark pattern of checkered design on grey ground with two characteristic dark transverse bars joining ends of floats.	Prevailingly large and "rough" (*i.e.*, intercostal membrane ribbed or cross-lined).
maculipennis ...	Two heavy black transverse bars on bright grey field, often with vague x-design in interbandal space ; black poles.	Almost always large, invariably rough.
Dappled eggs :		
atroparvus ...	Oblique dark cuneiform spots springing from the sides and tapering towards median line, sometimes by fusion extending across egg to form bands irregularly placed.	Small (variable) in size, wide and bulging in centre ; prevailingly "smooth" with a few cross-lines towards the extremities.
labranchiae ...	Brighter and broader than *atroparvus*; fewer and shorter cuneiform spots, with softer outline ; little constriction at waist ; black poles.	Very small, narrow, not protruding ; placed well toward one end of egg. Always "rough," with dense network of fine lines.
Without markings :		
elutus	Uniform bright grey without design.	Absent or rudimentary.

Key to the male adults (*after Shute*, 1935).

A. elutus—External spine blunt or round and of almost equal width throughout its length. Its length, which is a fairly constant character, is nearly two-thirds that of the apical spine.

A. maculipennis type—External spine blunt or round and of almost equal width throughout its length. Its length varies greatly, being in some examples very short, in others as long as the apical spine.

var. *atroparvus*—External spine always very sharp and tapering evenly from base to tip. The spine is nearly always double.

var. *labranchiae*—External spine always very sharp and tapering evenly from base to tip. The spine is usually single.

var. *messeae*—External spine short, medium, or long ; sharp, blunt, or rounded. It tapers little from base to tip and when pointed it sharpens suddenly just below the tip.

No difficulty is experienced in separating *elutus* from the remainder of the *A. maculipennis* group if the key by Edwards (8) (1921) is followed.

Mesonotum unicolourous : wing fringe all dark—*elutus*.
Mesonotum darker at sides : fringe usually pale at tip of wing—*maculipennis*.

When Edwards prepared the above key in 1921 it was not known that there were several varieties within the *A. maculipennis* group. However, as far as we know, all the varieties of *A. maculipennis* come within the above key and none falls into the above description of *elutus*.

Ginsburg, (9) 1938, states "a full species (with respect to another closely related species population) occurs when the degree of intergradation is not more than 10%."

We do not claim that the varieties of *A. maculipennis* can be classified in all cases by the shape and size of the wing scales—in fact this is not so—but what we do claim is that it can be used as a key for classification with an accuracy of over 90%. This is not surprising when it is remembered that even with species, identification is not always possible. Christophers (personal communication) has informed us that occasionally *A. minimus* and *A. fluviatilis* cannot always be separated with certainty. Therefore, even with well-recognised species, identification of every individual specimen may not be possible. This is also the case with the *eggs* of the varieties of *A. maculipennis*. We have found that in nature batches of eggs are occasionally found which do not precisely fall into any of the recognised groups, and other workers have made the same observations. Therefore, it is not surprising that occasionally a specimen fails to show wing scales which do not enable one to classify the variety with certainty. We believe that we are now in possession of a means whereby the majority of female *A. maculipennis* can be identified by the shape and size of the wing scales. This finding seems to us to justify the *A. maculipennis* group being considered as composed of species rather than of varieties, bearing in mind that there may be some degree of variation geographically.

We suggest, therefore, that in the light of present knowledge, biological and morphological, there are at least four species under *A. maculipennis* if we include *elutus*. We have not included *A. labranchiae* because we have not studied sufficient material, or made observations ourselves, to justify including this variety. However, we note that Bates (10) (1940), in referring to *labranchiae*, states that *labranchiae* and *atroparvus* are much more distinct than *melanoon* and *subalpinus*, but at the same time they do not seem to be as distinct as, say, *subalpinus* and *maculipennis*. However, *atroparvus* and *labranchiae* do exist together in some parts (Foggia, Italy) and, as far as is known, no transitional forms have been found.

On the other hand, the eggs appear to be the only means available for separating the two ; the male genitalia and the shape and size of the wing scales are not of any value in identification.

E. Ungureanu and P. G. Shute WING SCALES OF VARIETIES OF *Anopheles maculipennis*

ACKNOWLEDGMENTS.

We wish to express our thanks to the British Council for making a grant to one of us (E. U.) to come to England to complete this work. Also to the Ministry of Health for facilities provided at their Malaria Laboratory at Horton Emergency Hospital.

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EXPLANATION OF PLATE 1.

The shape of the wing scales of

Anopheles maculipennis atroparvus

Anopheles maculipennis messeae

Anopheles maculipennis maculipennis (as *typicus*)

TYPE SPECIMENS OF CULICIDAE DESCRIBED BY LAVERAN (DIPTERA : CULICIDAE)

By J. A. Reid, M.Sc., F.R.E.S.

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In 1901 and 1902 Laveran described and named six species of mosquitoes, four from French Indo-China and two from the Pacific, but no one else seems to have seen his specimens until they were discovered by Dr. J. Colas-Belcour and myself on 30th October, 1946, amongst a collection of slides belonging to Laveran in the Pasteur Institute in Paris. The specimens are mounted on slides in Canada balsam, and this is doubtless why they have remained unknown so long, workers presumably having looked for pinned specimens. No types are designated, but there can be no doubt that these are the specimens described by Laveran, for the data on the labels agree exactly, except for a misspelling of "Pursat" as "Pensat," with Laveran's published data, and are in his handwriting.

The species in question are as follows :—

1901	1902
Culex kermorganti	*Anopheles martini*
Panoplites seguini	*Anopheles pursati*
Anopheles vincenti	*Anopheles farauti*

Review of Synonymy.

Blanchard (1905) simply reprints Laveran's descriptions and places *A. vincenti*, *martini*, *pursati*, and *farauti* amongst his uncertain or insufficiently known species.

Theobald (1910 : 83) similarly places the four anophelines among those of uncertain position. He puts *C. kermorganti* under *Culex* (p. 400), and *P. seguini* under *Mansonia* (p. 451), considering the latter as possibly identical with *M. uniformis* Theobald.

Borel (1930) and Toumanoff (1936) do not mention Laveran's names.

Edwards (1932) treats them as follows :—

C. kermorganti becomes *Aëdes* (*Mucidus*) *kermorganti* Laveran.

P. seguini synonym of *Mansonia* (*Mansonioides*) *annulifera* Theobald, 1901, *Mon. Cul.* **2** : 183.

A. vincenti ? synonym of *Anopheles* (*Myzomyia*) *minimus* Theobald, 1901, *Mon. Cul.* **1** : 186.

A. martini ? synonym of *Anopheles* (*Anopheles*) *barbirostris* Van der Wulp, 1884, *Notes Leiden Mus.* **6** : 248.

A. pursati ? synonym of *Anopheles* (*A.*) *sinensis* Wiedemann, 1828, *Aussereurop. Zweifl. Ins.* **1** : 547, which is itself treated as a synonym of *A. hyrcanus* Pallas, 1771, *Reis. Russ. Reichs.* **1** : 475. N.B., the usual practice at present is to treat *sinensis* as a variety of *hyrcanus*.

A. farauti synonym of *Anopheles* (*M.*) *punctulatus* Dönitz, 1901, *Insektenörse* **18** : 372.

Christophers (1933), who gives the location of types, states that those of *A. vincenti* and *martini* are unknown, and makes no comment on that of *pursati*. He employs the following synonymy :—

A. vincenti ? synonym of *A.* (*M.*) *aconitus* Dönitz, 1902, *Zeit. f. Hyg.* **41** : 70.

A. martini ? synonym of *A. barbirostris* following Edwards.

A. pursati ? synonym of *A. hyrcanus* var. *nigerrimus* Giles, 1900, *Handb. Gnats.* (ed. 1) : 161, rather than of var. *sinensis*.

Barraud (**1934** : 127) follows Edwards and treats *P. seguini* as a synonym of *Mansonia annulifera* Theobald, stating that the type is non-existent.

It will be seen from the above, especially the opinions of Edwards and Christophers, that except for *Mucidus kermorganti* all these names of Laveran's appear to be synonyms of species which are of the first importance medically as vectors of malaria and/or filariasis, and for this reason it is necessary, now that the specimens have come to light, to try to settle the synonymy with more certainty. I have examined the anopheline material and my conclusions are given below, but unfortunately there was no time to study the Culicines.

Notes on the Specimens.

Aedes kermorganti (Laveran)

C.R. Soc. Biol. Paris 53 : 568. Nouméa, New Caledonia, 17th March, 1901. Described from 2 ♀.

Type Material : One specimen dissected and mounted on two slides labelled "New Caledonia, Nouméa, 17th March, 1901. *C. kermorganti.*"

Additional Material : None seen.

Comment. Should be compared with other material identified as this species.

Mansonia seguini (Laveran).

C.R. Soc. Biol. Paris 53 : 992. Hanoi military hospital. Dr. Seguin, July–Sept., 1901.

Type Material : (i) A slide with 1 ♀ labelled "*Mansonia seguini.* Hanoi military hospital, guard room, 4th Sept., 01."

(ii) A slide with 2 ♀ much smaller than the first, labelled "*P. seguini.* Hanoi. Sept., 01., Dr. Seguin's room."

(iii) A slide with three mosquitoes labelled "*Culex* (2 kinds), 1 *P. seguini* ♂. Dr. Seguin's room. Hanoi, Tonkin, 4th Sept., 01."

Additional material. Six other slides labelled *M. seguini* with dates in 1902 and 1903.

Comment. The specimens need to be determined and may be mixed. The scales of the mesonotum will almost certainly be missing, but if the male genitalia and the teeth on abdominal segment 8 in the female are visible, determination should be possible.

Anopheles vincenti Laveran, 1901.

C.R. Soc. Biol. Paris **53** : 993. Van Linh, Haut-Tonkin. Dr. Chagnolleau. No date given, but probably about January or February, 1901.

Type Material : One slide with 5 ♀ labelled "*A. vincenti*, Ht. Tonkin, Van Linh."

Additional Material : Two other slides with a total of twelve specimens. Dong-Dang. Tonkin, Sept.–Nov., 1903.

Comment. It appears to me that three of the specimens are *A. minimus* and the other two *A. jeyporiensis*. The important characters visible on the specimens are :—

(i) For the three *minimus*. Wings without pale fringe spot at termination of vein 6, proboscis not appearing paler in apical half, apical and sub-apical pale bands of the palps sub-equal, tarsi with only very small faint pale bands, and wings apparently with a small pale spot on the costa in the basal third. It is difficult to be sure about the last point because pale scales are exceedingly difficult to see in balsam preparations, and this part of the wing overlies the thorax.

(ii) For the two *jeyporiensis*. Sub-apical pale band of the palps narrow, only about half the apical. Wing with fringe spot at vein 6, and pre-apical dark mark on vein 1 with a pale interruption (see Toumanoff, fig. 52, *A. jeyporiensis* var. *tonkinensis*). Fore tarsi apparently with well-marked pale bands. The scales of the mesonotum are lost.

Laveran's description of *vincenti* fits *minimus* much better than *jeyporiensis* ; in particular the tarsi are described as unbanded which agrees with *minimus*, but not at all with *jeyporiensis* which has narrow but very distinct pale bands on the tarsi. It is assumed that Laveran's descriptions are based, at least in part, on examination of the specimens before they were mounted in balsam ; the descriptions give that impression. The following statements are also relevant :—

(i) "L'extremité apicale des palpes est de couleur claire, garnie de poils blanchâtres ; il existe en outre un anneau blanchâtre à l'union des deuxième et troisiéme articles des palpes."

In *minimus* not infrequently the two apical pale bands nearly meet, the intervening dark band being then narrow, ill defined and not obvious; in *jeyporiensis* the sub-apical pale band is narrow and the intervening dark band is sufficiently obvious, so that the palps clearly have three pale bands.

(ii) "Sur le bord antérieur des ailes, on distingue quatre taches noirâtres, allongées séparées par de petits espaces clairs, jaunâtres."

Five dark spots would be a more appropriate description for *jeyporiensis*, in which the additional basal pale interruption is usually broad and obvious, and could be readily seen in Laveran's two specimens. In *minimus* this interruption is frequently very small—it was barely visible in the specimens under discussion—or may be absent (Toumanoff, p. 151).

In view of the above, and the fact that the majority (three-fifths) of the specimens are *minimus*, it is evident that Edwards was correct, and *A. vincenti* Laveran, 1901, is a synonym of *minimus* Theobald, 1901,

which has priority by one week. The dates of publication of these two names given by Edwards (p. 52) have been checked at the British Museum (Natural History), with the kind help of Mr. H. Oldroyd. The name *annulifera* Theobald has the same priority over *seguini* Laveran.

Anopheles martini Laveran, 1902.

C.R. Soc. Biol. Paris **54** : 906. West of Pursat, Cambodia. February, 1902.

Type material : Two slides each with 1 ♀, both labelled "*A. martini.* Mountains of Pensat. Cambodia. February, 1902."

Additional material : Three other slides labelled *martini* with eight specimens. Cambodia and Saigon, 1902 and 1904.

Comment. Both specimens are *A. barbirostris* Van der Wulp (1884). Through the kindness of Dr. H. C. Blöte I have examined Van der Wulp's type of that species in the Leiden Museum. Laveran's specimens show the shaggy all-black palps, tuft of black scales on abdominal segment 7 beneath, with pale scales on the other segments, and a narrow pale fringe spot at termination of vein 3.

Anopheles pursati Laveran, 1902.

C.R. Soc. Biol. Paris **54** : 906. West of Pursat, Cambodia. February, 1902.

Type Material : One slide with 2 ♀ labelled "*A. pensati.* Mountains of Pensat, Cambodia. Feb., 1902."

Additional Material : None seen, though numerous slides labelled *A. sinensis.*

Comment. As has been supposed, this is *A. hyrcanus* Pallas (1771). The scale tufts on the clypeus are visible in both specimens, and the tuft of scales on abdominal segment 7 beneath, in one.

The hind legs of both specimens are missing, but as there is no fringe spot at vein 5·2, and the basal dark marks on 5 and 6 appear to be long, though it is barely possible to make them out as this part of the wing overlies the thorax, the specimens can scarcely be *sinensis* in the usually accepted sense. Disregarding vars. *lesteri* and *pseudosinensis* of Baisas and Hu (1936), which I do not think have yet been recognised outside the Philippines, and excluding var. X of Venhuis (1939) which is well known to me and is certainly not the same as *pursati*, *nigerrimus* is the only other recognised named variety in this region, so it is probably best for the time being to follow Christophers and regard *pursati* as a synonym of *A. hyrcanus* var. *nigerrimus* Giles, 1900. I do not believe, however, that *pursati* belongs to the same form as that represented by Giles' type of *nigerrimus*, nor can I quite reconcile it with any of the forms known to me. However, specimens of var. *sinensis* from Indo-China which I have examined show a striking amount of variation, and if this can be investigated and material of vars. *lesteri* and *pseudosinensis* becomes available for study, it may be possible to identify *pursati*, though the balsam mounting will always cause great difficulty.

Anopheles farauti Laveran, 1902.

C.R. Soc. Biol. Paris **54** : 908. Faureville, Ile Vaté. January, 1902. Females only.

Type Material : Three slides, each with 2 ♀, all labelled "*A. farauti*. Faureville. Ile Vaté. New Hebrides. Jan., 02."

Additional Material : None seen.

Comment. Recently it has been shown (Knight and Farmer, 1944 ; Belkin, Knight and Rozeboom, 1945 ; Rozeboom and Knight, 1946) that the name *moluccensis* Swellengrebel and Swellengrebel de Graaf, 1920, hitherto used for a variety of *A. punctulatus* Dönitz, 1901, is a synonym of *farauti*, which therefore replaces it. Over a year's collecting on Ile Vaté, the type locality of *farauti*, produced only the one form in the *punctulatus* complex, so the presumption was that Laveran's specimens must have been of this form, which was later shown to be the same as *moluccensis*.

Examination of the type material shows this presumption to be correct. In all six specimens there is barely a trace of the scales left on the scutum, but the labium is dark-scaled except for a minute pale ring at the extreme apex, and the halteres, where visible, are dark-scaled apically (Belkin *et al.*, p. 241), whilst the palps agree closely with type "A" (Rozeboom and Knight, pl. VI). In other words, *A. farauti* as defined by these authors agrees with Laveran's original specimens of this species.

I wish to thank Professor E. Roubaud for kind permission to study the mosquito collection at the Pasteur Institute, and Dr. J. Colas-Belcour of that Institute for his valuable help. My thanks are also due to Dr. E. Séguy of the National Museum of Natural History, Paris, for his courteous assistance.

Summary.

1. The type material of six species of oriental and pacific mosquitoes, described by Laveran in 1901 and 1902, has been found in the Pasteur Institute in Paris. The specimens are mounted on slides in balsam.

2. Opinions on these species and synonymy published by others is reviewed.

3. A list of the specimens with their collection, and other relevant data, is given, and determinations of the four species of *Anopheles*. These determinations which agree in all important respects with the opinions of Edwards are as follows :—

A. vincenti Laveran, synonym of *A. minimus* Theobald.

A. martini Laveran, synonym of *A. barbirostris* v. d. Wulp.

A. pursati Laveran, synonym of *A. hyrcanus* Pallas, and provisionally a synonym of *A. hyrcanus* var. *nigerrimus* Giles.

A. farauti Laveran, a valid species (or variety) in the *punctulatus* complex agreeing with the *farauti* of Knight *et al.* (1944, 45, 46), who sink *moluccensis* Swellengrebel and Swellengrebel de Graaf as a synonym of *farauti*.

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BOOK NOTICE.

Catalogo de los Dipteros de Chile. By C. S. Ortiz. 8vo. Santiago de Chile (Ministerio de Agricultura). 1946. Pp. 1–250+2.

Professor C. P. Alexander, in his preface to this work, states that the dipterous fauna of Chile has proved to be one of the richest and most interesting in the world, although the early collectors of Chilean insects gave little indication of this wealth of rare and unusual forms. The results of the expedition of F. W. Edwards and R. C. Shannon recorded in the *Diptera of Patagonia and South Chile* gave a stimulus to work in this field and in recent years much further attention has been paid to the Diptera of this region.

The present catalogue is estimated to include the names of some 2,143 species, indicating a great advance in the knowledge of Chilean Diptera, and should prove an invaluable aid to the systematic worker in this field.

An extensive bibliography and index of genera and species complete the work.

NEW SPECIES OF INDIAN EPHEMEROPTERA

By D. E. Kimmins

The material upon which this paper is based was collected during the period October, 1945, to early January, 1946, whilst the author was serving with the Royal Air Force in India. The main area in which collecting was done lay to the north of Calcutta, near Dakhineswar (adjacent to the new Willingdon Bridge over the Hooghly River). The country is flat and low, and abounds in large ponds, known locally as "tanks" or "gheels." The water is static and warm, and, as might be expected, the ephemeropterous fauna appears to consist solely of members of the families Baetidae (*Cloëon*, etc.) and Caenidae. Five species of the former and two of the latter were collected, six of the seven species being here described as new to science. Collections were also made at another locality about two miles nearer Calcutta, and at the Calcutta Botanic Gardens. Indian species of *Cloëon*, like our British species *C. dipterum*, are quite at home in urban surroundings, and the author has seen large swarms of males dancing in the sunlight in the centre of Calcutta.

The author wishes to express his sincere thanks to Dr. S. L. Hora, Director of Fisheries, Bengal, and to Dr. B. N. Chopra, Director, Zoological Survey of India, for their ready assistance in providing him with collecting equipment, which he was unable to bring with him by air from England.

Before proceeding to the description of the various species, it should be pointed out that, in the absence of such direct evidence afforded by specimens taken *in coitu*, the association of males and females of the various species of *Procloëon* and *Cloëon* must be regarded as provisional. This fact, together with the good characters offered by the female wings, has influenced me in selecting females as holotypes of the various species. In the case of the two species of *Caenis*, only one species was on the wing at the time of capture. Unless otherwise stated, the descriptions have been made from specimens collected into alcohol and subsequently preserved in 2% formalin.

The types of all species have been presented to the British Museum (Natural History), but whenever possible paratype material is being sent to the Zoological Survey of India.

Family Baetidae.

Procloëon bimaculatum (Eaton) (figs. 1, 5, 9).

Cloëon bimaculatum Eaton, 1884, *Trans linn. Soc. Zool.* (2) **3** : pl. 17, fig. 31*d*; 1885, *op. cit.* : 182 (Ceylon).

The type series of this species is now in the British Museum (N.H.). It consists of one male and seven females, all somewhat imperfect. The male is mounted on a card, together with two of the females, and as regards the wings it is difficult to reconcile it with Eaton's description.

Indeed it would appear that the description of the wings of this species has been made from a female example, as in the male specimen there is no trace of the pterostigmatic pattern he describes. I have therefore selected as holotype of this species one of the females.

Examination of the proportionate lengths of the 1st and 2nd segments of the hind tarsus (3 : 1) suggests that this species should be transferred to the genus *Procloëon* Bengtsson. The venational character given by him (first cross-vein between R1 and R2 in line with the one below it) has been shown to be variable and unreliable.[1] Among the material collected near Calcutta in November, 1945, are a number of specimens which I believe to belong to this species, in spite of the distance from the type locality, Ceylon. In life the body of the female is light green in colour, with sparse reddish markings. At rest it sits with the wings slightly separated, and the abdomen sinuously upcurved between them.

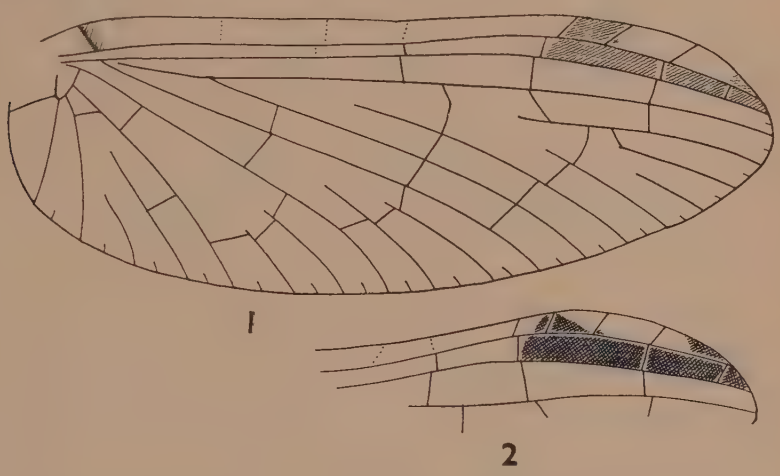


Fig. 1. *Procloëon bimaculatum* (Eaton). ♀ Right wing.
Fig. 2. *Procloëon harveyi* sp. n. ♀ Pterostigmatic region of right wing.

Female. General colour whitish, with sparse reddish markings. Head immaculate, antennae with small red spots apically on the inner and outer sides of two basal segments, style blackish apically. Pronotum with a faint reddish sagittate spot on disc. Abdomen with a pair of reddish triangles, one in each apical angle of the 3rd tergite. Tergites 1 to 7 faintly reddish apically (fig. 9). Setae white, irregularly banded with black. Anterior femur with two pale orange bands on inner surface, median and posterior femora each with a faint sub-apical reddish ring. Wings hyaline, veins pale brownish, cross-veins white. Pterostigma brownish with a sub-apical pale spot in costal area; humeral cross-vein marked with reddish, area between it and pterostigma very faintly yellow-brown (fig. 1).

Male. Head fulvous, turbinate eyes fulvous-orange, scarcely wider at apex than at base, lower eyes blackish. Antennae fulvous, shaded with brownish at apices of 1st and 2nd segments. Thorax fuscous, sutures paler. Abdominal segments 1 to 7 very pale fuscous, 8 to 10 rather darker fuscous. Tergites 1 to 6 each with a narrow reddish apical line, interrupted at its centre, and tergites 2, 3 and 6 in addition each with a dark reddish-brown

[1] Kimmins, D. E., 1942, *Sci. Publ. Freshwater Biol. Assoc.* 7 : 40.

triangular spot on each side, tergites 8 to 10 with indefinite fuscous markings (fig. 5). Sternites very pale fuscous, 2 to 7 each with a pair of indistinct short divergent dashes at base, 7 and 8 each with a pair of reddish longitudinal lines, 9 faintly marked with reddish. Forceps light fuscous, becoming paler apically. Between their bases is a triangular process, whose rounded apex is upcurved in the form of a hook. Setae whitish, with alternate joints ringed with light fuscous. Legs whitish, anterior femur with a reddish ring in apical half, a small spot externally at base. Wings hyaline, venation pale fuscous, cross-veins whitish, a distinct red spot on posterior end of humeral cross-vein and base of radius. Three or four cross-veins in pterostigma.

Length of wing: ♂ 4·5 mm., ♀ 5 mm.; of body: ♂ 5 mm., ♀ 6 mm.

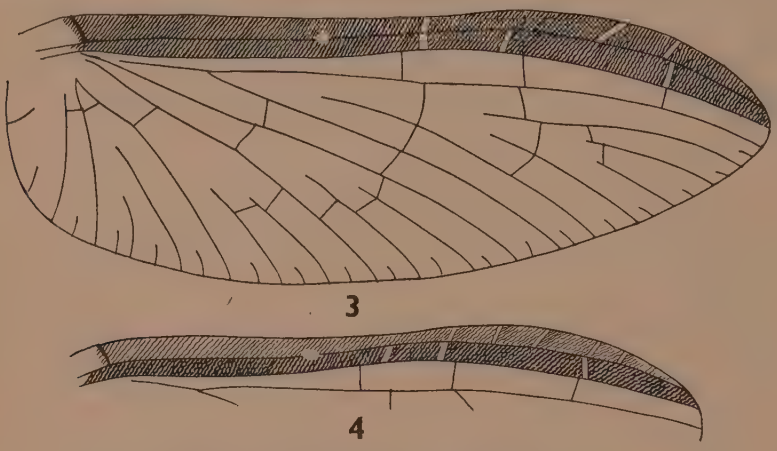


Fig. 3. *Cloëon bengalense* sp. n. ♀ Right wing.
Fig. 4. *Cloëon bicolor* sp. n. ♀ Costal region of right wing.

Bengal: Calcutta, Nov.–Dec., 1945 (*D. E. Kimmins*). Males and females in the collections of the British Museum (N.H.) and the Zoological Survey of India. Females were found at rest during the day on the walls of buildings and the males were seen flying in swarms at 0800–0830 hours in November and 1430–1600 hours in December (Bengal Standard Time). During the latter month, no males were seen on the wing in the early morning.

Procloëon harveyi sp. n. (figs. 2, 6, 10).

Allied to *P. bimaculatum* (Eaton), but distinguishable therefrom in the female sex by its luteous ground colour (in life), differences in body markings, and by its darker pterostigma.

Female. Head pale luteous, base of oculi and four small dorsal spots reddish. Eyes black, antennae with basal segments generally pale, second segment tipped with reddish. Prothorax luteous, with a median reddish stripe, narrow anteriorly and extending basally as a narrow border, and with a dark spot in each posterior angle. Mesonotum pale, darker posteriorly, metascutum brownish. Abdomen luteous dorsally, with conspicuous red-brown markings on tergites 2, 3 and 6, and with smaller spots on other tergites as in fig. 10. Ventrally pale luteous, with two reddish lines which tend to fuse on the apical segments. Setae whitish, with alternating long and short blackish marks. Anterior femur orange-brown, dorsally with two pale spots, tibia and tarsus whitish. Median and posterior legs whitish, femora with indistinct blackish markings. Pterostigma dark brown as in fig. 2, remainder of

costal and subcostal areas with indefinite pale brownish markings, a strong reddish-brown spot over humeral cross-vein.

Male. Eyes light fulvous, slightly more dilated than in *P. bimaculatum*, lower eyes green. Antennae pale fulvous, apex of 2nd segment dark brown. Thorax medium brown, with considerable paler areas on each side dorsally. Abdomen translucent whitish, with considerable reddish-brown markings (fig. 6). First tergite with vague reddish suffusion, 2 and 3 each with a distinct triangular patch in apical angles, 4 and 5 with a narrow apical line interrupted centrally, 6 with a triangular patch in each apical angle, 7 with a pair of less defined reddish patches, 8 and 9 mostly reddish-brown, 10 with a trifid fuscous mark. Ventrally whitish, with a median red-brown band on sternites 8 and 9, and apex of 7. Forceps whitish, shaped much as in *P. bimaculatum*, chitinous process between them more pointed. Setae white, with sparse reddish annulations. Legs whitish, anterior femur banded with reddish apically, median and posterior femora with fine reddish-black lines on ventral carinae. Wings hyaline, venation pale fuscous, with a red-brown dot at junction of radius and humeral cross-vein.

Length of wing : ♂ 4 mm., ♀ 4 mm. ; of body : ♂ 5 mm., ♀ 6–7 mm.

BENGAL : Calcutta, Oct.–Dec., 1945 (*D. E. Kimmins*).

Holotype female in collections of the British Museum (N.H.), paratypes male and female in collections of the British Museum (N.H.) and the Zoological Survey of India.

Many of the specimens, especially the males, were damaged by the journey through the post to England. This species is named after Mr. J. W. Harvey, a good naturalist and brother officer with whom I spent much of my off-duty time in the R.A.F., both in England and in India.

Cloëon bengalense sp. n. (figs. 3, 7, 11).

? *Cloëon marginale* (Hagen), Eaton, 1885, *Trans. linn. Soc. Zool.* (2) **3** : 181 (♀).

The wing marking of the female of this species very closely resembles that described by Eaton in the female of *Cloëon marginale* (Hagen). This latter species was, however, described from one or more female subimagines, and the female imago later attributed to it by Hagen has been shown by Eaton to be a *Teloganodes*, not *Cloëon*. Amongst the examples in the McLachlan collection determined by Eaton as *Cloëon marginale* (Hagen) are females of two different species. One of these females, from Ceylon, agrees very well with his description of *C. marginale* and the other (from N.W. India) is more the pattern of my second species of *Cloëon*. This confusion has raised doubts whether his example from Ceylon is truly a female of *C. marginale* (Hagen). Collecting in the type locality (Rainbodde, Ceylon) is needed to establish the identity of Hagen's species, and under the circumstances I have thought it wiser to treat as new the species represented by my series from Calcutta.

The living female is light blue-green, with a dark brown median dorsal stripe. Eyes blue-green, legs greenish, setae white, faintly annulated with brownish. In fluid the blue-green colour fades to a creamy white.

Female. Head whitish, with two broad, dark brown stripes covering the greater part of the head, antennae with the two basal segments heavily marked with dark brown apically. Pronotum with two broad, almost contiguous, median, red-brown stripes, and a small spot towards each posterior angle. Meso- and metanota with a broad, dark brown, median band, median suture finely whitish. A red-brown spot above posterior coxa. Abdomen dorsally

with a reddish-brown stripe occupying about one-half of total width (fig. 11). On tergites 3 and 6 the band is expanded laterally almost to the margins, and on tergites 2 to 9 there is a narrow, median, pale area and a pair of elongate, divergent, pale spots basally within the dark band, and on tergites 2 to 7 there is also a small dark spot laterally towards each basal angle. Ventrally whitish, with a small dark brown spot laterally on sternites 2 to 8. Setae whitish, faintly annulated with brownish. Legs whitish, anterior femora shaded with red-brown on anterior surface. Wings hyaline, with dark brown venation, costal and subcostal areas dark brown (except basad of the humeral cross-vein), cross-veins and bulla white.

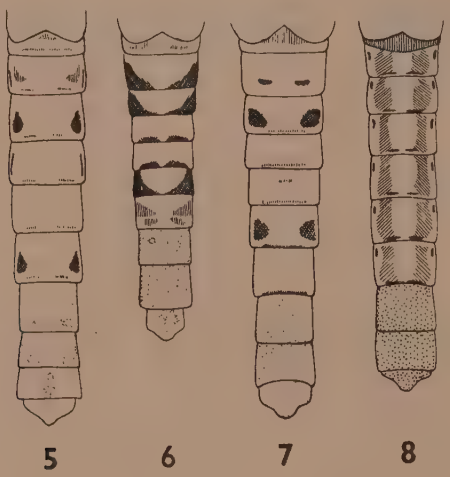


Fig. 5. *Procloëon bimaculatum* (Eaton). ♂ Abdominal pattern, dorsal.
Fig. 6. *Procloëon harveyi* sp. n. ♂ Abdominal pattern, dorsal.
Fig. 7. *Cloëon bengalense* sp. n. Abdominal pattern, dorsal.
Fig. 8. *Cloëon bicolor* sp. n. ♂ Abdominal pattern, dorsal.

Male. Head dark luteous, with orange brown eyes ; antennae luteous with dark brown markings on apices of two basal segments. Thorax dark brown, with paler markings on sides and beneath. Abdomen either translucent or opaque whitish, with red-brown markings varying in intensity in individuals (fig. 7). Tergites 2 to 7 with slight reddish or fuscous shading at apices, 2 with a pair of indefinite reddish spots, 3 and 6 with strong reddish spots, 8 to 10 either fuscous or reddish. Ventrally whitish, except 8 and 9, which are pale fuscous. Forceps of the pattern of *C. dipterum*, basal segment pale fuscous, remainder white. Setae white, with sparse reddish or fuscous annulations. Legs whitish. Wings hyaline, venation pale fuscous, stronger at base of costa and radius.

Length of wing : ♂ 5 mm., ♀ 5 mm. ; of body : ♂ 5 mm., ♀ 6 mm.

Bengal : Calcutta, Oct.–Dec., 1945 (*D. E. Kimmins*).

Holotype female in British Museum (N.H.), paratypes male and female in British Museum (N.H.) and Zoological Survey of India.

The males assigned to this species were on the wing during the middle of the day in November and December. The females of this species and also those of the two following species sit with the wings closely pressed together over the back, the body straight and not upcurved between them.

Cloëon bicolor sp. n. (figs. 4, 8, 12).

Female (in fluid). Head warm luteous, with two castaneous longitudinal stripes, one on each side of the median line; eyes light grey (in life light blue-green); antennae pale luteous, basal segment internally with a piceous spot, 2nd with a piceous apical ring, style piceous except at base. Pronotum luteous with a pair of castaneous median stripes, and a spot or narrow line towards basal angles. Mesonotum pale luteous, with narrow line towards basal angles. Mesonotum pale luteous, with narrow brownish median and humeral stripes. Abdomen luteous, with a median dorsal castaneous band, not widened on segments 3 and 6 (fig. 12). Tergites 2 to 8 basally with a lanceolate median, and two triangular pale spots, and a small castaneous line on lateral margins. Setae pale, with sparse blackish rings. Legs luteous, anterior femora light castaneous above. Wings hyaline, with a luteous costal and dark brown subcostal streak. Costa, subcosta, radius and cross-veins in costal and subcostal areas pale, remainder of venation fuscous.

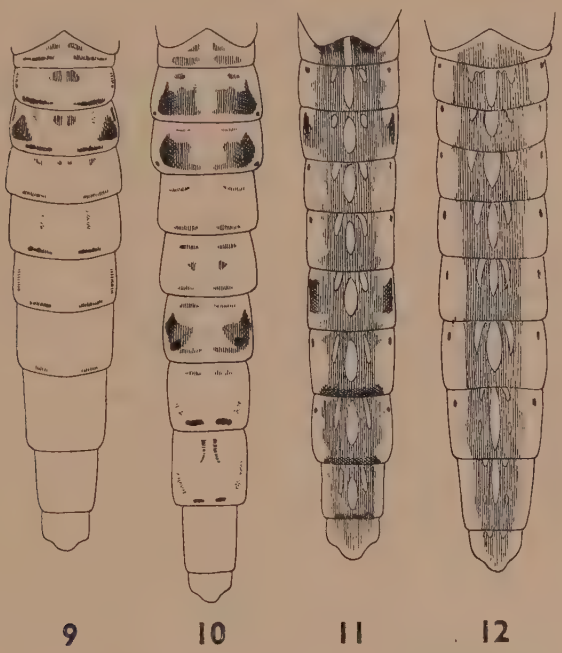


Fig. 9. *Procloëon bimaculatum* (Eaton). ♀ Abdominal pattern, dorsal.
Fig. 10. *Procloëon harveyi* sp. n. ♀ Abdominal pattern, dorsal.
Fig. 11. *Cloëon bengalense* sp. n. ♀ Abdominal pattern, dorsal.
Fig. 12. *Cloëon bicolor* sp. n. ♀ Abdominal pattern, dorsal.

Female subimago (in fluid). Wings light greyish with faint indications of costal streak. Imaginal body markings showing through the skin, ground colour in life pale green.

Male (in fluid). Eyes orange to orange-yellow. Thorax pale brown, often with a darker median stripe. Abdomen translucent white or whitish, segments 8 to 10 reddish or orange-brown above, white, sometimes tinged with reddish, beneath (fig. 8). Segments 2 to 7 vary considerably in the extent of their markings, from a suggestion of a reddish-brown transverse apical line to a definite pattern of two reddish triangles and a short reddish lateral line on the tergites, and a suffusion of reddish and a reddish lateral line on the sternites.

Setae and forceps white, the latter similar in pattern to *C. dipterum*. Legs whitish, anterior femur finely lined with piceous. Wings hyaline, venation pale piceous, except costa, subcosta and pterostigmatic cross-veins, which are white.

Length of wing : ♂ 4 mm., ♀ 4·5–5 mm. ; of body : ♂ 5 mm., ♀ 5 mm.

BENGAL : Calcutta, Nov. 1945–Jan. 1946 (*D. E. Kimmins*).

Holotype female in British Museum (N.H.), paratypes male and female in the British Museum (N.H.) and the Zoological Survey of India.

This species resembles *C. bengalense* Kimmins, but may be distinguished in the female sex by the paler, bicoloured costal streak and the difference in the abdominal pattern, which lacks the lateral extensions on segments 3 and 6. The male may be distinguished by the absence of the reddish spots on segments 3 and 6. The males were taken flying in small swarms, generally about 8–10 feet from the ground, between 1700 and 1730 hours, Bengal Standard Time. The females were fairly abundant on the walls of buildings, window-screens, etc., and the subimagines taken at light and also on the wing, 1730 hours, in January.

Cloëon viridis sp. n.

Female in life with apple green body, marked with reddish-brown, costal stripe yellow-green.

Female. Head pale yellowish-green, with two narrow reddish-brown stripes ; antennae with two basal segments tipped with blackish. Eyes greyish (in life blue-green), with two parallel reddish lines on anterior half. Thorax yellowish-green, with a median and a narrower lateral band of reddish-brown. Abdomen yellow-green, with a broad dorsal band of reddish-brown. Tergites 2 to 7 with three pale basal marks much as in *C. bicolor*, and lateral marks on the tergites and sternites as in that species. Setae pale, with alternate narrow and broad dark annulations. Legs yellowish, anterior femur faintly reddish. Wings hyaline, with dark brown venation, except costa, subcosta and radius, which are pale. Costal and subcostal areas pale yellow-green.

Length of wing : 5 mm. ; of body : 6 mm.

BENGAL : Calcutta, Oct. 1945 (*D. E. Kimmins*).

Holotype female and paratypes in the British Museum (N.H.).

This species was much less frequently met with than either of the two foregoing species, and I have been unable to associate any male with it with any degree of certainty. It resembles the female sex of *C. bicolor* Kimmins in markings of body, but is distinguished by the rather broader pale area dividing the head stripes, and particularly by the yellow-green costal stripe.

In addition to the foregoing, the following three Indian species of the genus *Cloëon* have been described :—

Cloëon marginale (Hagen), 1858, *Verh. zool.-bot. Ges. Wien* **8** : 477 (Ceylon).

Cloëon pulchella Banks, 1913, *Proc. ent. Soc. Wash.* **15** : 137 (Bengal).

Cloëon taeniolatum Navas, 1932, *Rev. Ac. Ci. Zaragoza* **15** : 21 (Bombay).

Family Caenidae.

Caenis piscina sp. n. (fig. 13).

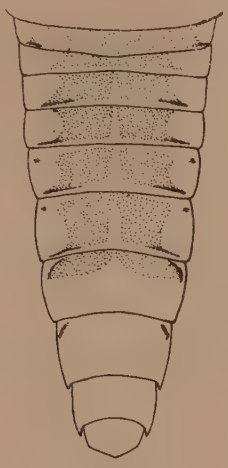
Male (dried). Head and thorax pale yellowish-brown, slightly greyish above, eyes purple-black. Abdomen translucent whitish, lateral margins of sternites, and also apical margins of some basal tergites, lightly marked with blackish, terminal segments cream. Setae and forceps white. Legs whitish, except anterior, which are shaded with purplish-grey. Wings hyaline, veins whitish, except subcosta and radius, which are purplish-black.

Female (in fluid). Rather more greyish than the male, and with a definite pattern of purplish-grey on tergites 1 to 7 (fig. 13). A small purplish spot on apex of median and posterior femora.

Length of wing : ♂ 2 mm., ♀ 2 mm. ; of body : ♂ 2 mm. ♀ 3 mm. ; of setae : ♂ 7 mm., ♀ 3 mm.

Bengal : Calcutta, Oct. 1945, at light and in spiders' webs (*D. E. Kimmins*).

Holotype male (dry) and paratypes male and female (dry and in fluid)in the British Museum (N.H.).



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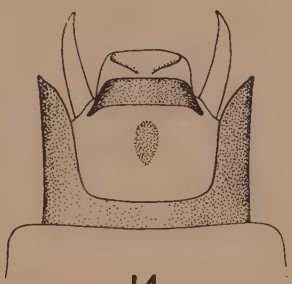

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Fig. 13. *Caenis piscina* sp. n. Abdominal pattern, dorsal.
Fig. 14. *Caenis picea* sp. n. ♂ Apex of abdomen, ventral.

Caenis picea sp. n. (fig. 14).

Male. Head and compound eyes cool dark brown. Antennal segments and base of style grey, remainder of style white. Second segment of antenna tapering from base to apex. Thorax dark brown, whitish in parts on sides and ventrally. Abdominal tergites 1 to 8 whitish or very pale fuscous, 3 to 6 sometimes faintly margined apically with a pale reddish line, interrupted medianly. Tergites 9 and 10 cool pale brownish. Ventrally whitish, sternite 9 marked with cool brownish at sides, base and apex, and with an ovate median spot. Claspers whitish-grey. Setae white, with brownish basal segments. Legs white, anterior femur and apex of tibia with considerable grey markings dorsally. Wings hyaline, venation white apart from subcosta and radius, which are purplish-red.

Male subimago. Similar in general colour, but with purplish-grey markings on anterior tibia and tarsus.

Female imago. Paler than male. Thorax pale brown, with a paler sagittate mark posteriorly, its apex caudad. Abdomen creamy white, only slightly suffused with greyish apically and on tergites 1 and 2. Setae whitish.

Bengal : Calcutta, reservoir of Baranagar-Kamarhati Waterworks, 29.xii.1945, 5.i.1946. 1615–1730 hours, Bengal Standard Time (*D. E. Kimmins*).

Holotype male in the British Museum (N.H.), paratypes male and female in the British Museum and Zoological Society of India.

On 29th December large numbers of this small Caenid appeared on the wing near and at the edge of the reservoir. Hatching was not observed, though duns were taken. It has a fairly active flight, resembling that of a swarm of Chironomids, but slower.

BOOK NOTICE.

Fleas of Western North America—their relation to the public health. By C. A. Hubbard. Pp. x+533, frontisp., pls., text illust. 8vo. Ames, Iowa (Iowa State College Press), 1947. Price U.S. $6.00.

This books deals with the fleas of that area of North America west of the 100th meridian, which includes the eastern approaches of the Rocky Mountains, the Rocky Mountains, the Great Basin, the Great Cascade Sierra chain of mountains, the valleys between the Cascade-Sierras and the Coast Range, the Coast Range and the Pacific Slope. This area includes 66 genera and over 230 species and subspecies, some of which are important vectors of disease.

The work has been based on material collected by the author or his colleagues personally.

The text is divided into three sections. Part 1 deals with the contribution of earlier workers to the knowledge of the fleas of western America, the medical importance of fleas, field and laboratory technique and the anatomy of the flea in relation to its taxonomy.

Part 2 deals with the five subfamilies of Siphonaptera, Hectopsyllidae, Pulicidae, Dolichopsyllidae, Hystrichopsyllidae and Ischnopsyllidae.

Part 3 covers the hosts of western rodent fleas and western lagomorpha fleas, their relation to plague, tularemia and murine typhus.

A bibliography of four pages and series of indices complete the work.

DEUX *PROISOTOMA* DE L'INDE (COLLEMBOLA)

PAR J. R. DENIS

(*Dijon.*)

Proisotoma fitchioides sp. n. (figs. 1–5)

Taille : 0·8 à 0·85 mm. ♂ et ♀. Coloration mal conservée, mais sans doute très foncée, les pattes et la furca restant claires. Aspect habituel dans le genre. Revêtement très uniforme, fait de sois simples dont la longueur, sur abd. 4, ne vaut guère que le 1/5 ou le 1/6 de celle du segment; 8 yeux subégaux par côté. Antennes de l'ordre de longueur de la diagonale de la tête. Au moins 5–6 poils olfactifs sont reconnaissables sur ant. IV ; souvent on en distingue davantage. Postantennal large (fig. 2). Tibia avec un subsegment distal incomplet. Très caractéristiques sont les ergots, longs, épais, nettement spatulés à l'apex : 1 aux p. 1, 2 aux p. II et III (fig. 1) et alors l'un des deux dorsal, l'autre sur la face antérieure du tibia. Griffes sans dents ; appendice empodial simple, aigu, mais non étiré en filament à l'apex. Tenaculum avec une soie lisse au corpus et seulement 3 dents à chaque ramus. On peut souvent deviner une ébauche—ou un rudiment—de quatrième dent proximale (fig. 3), mais jamais cela ne ressemble aux dents véritables. Manubrium sans soies ventrales. Dens à surface dorsale pourvue de bosses irrégulières (fig. 4). Le revêtement dorsal de la dens, étudié sur une vingtaine d'exemplaires, peut être considéré comme pratiquement constant. Dans le tiers basal, on a 5 soies et, dans le tiers distal, on en a 2. Ventralement est une unique soie subdistale. Mucron à deux dents avec lamelles nettes assez basses (fig. 5).

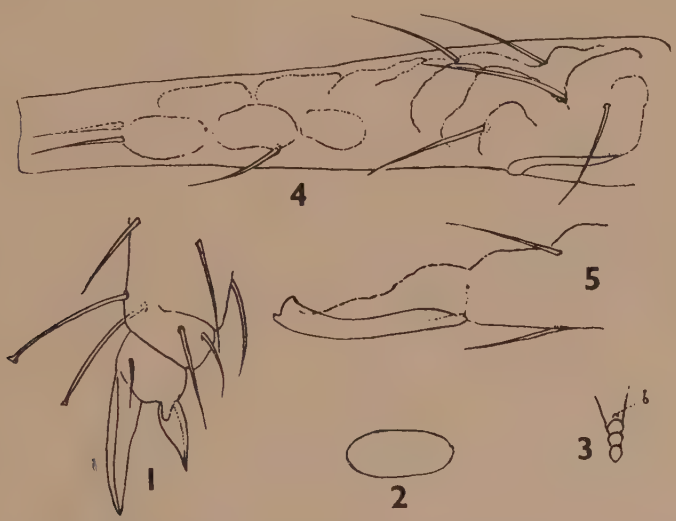

FIG. 1–5. *Proisotoma fitchioides* sp. n. 1, g3 ; 2, postantennal ; 3, ramus tenaculi ; *b*, vestige de dent basale ; 4, dens, face dorsale, la soie ventrale subapicale vue par transparence ; 5, mucron, face latérale.

INDIA : Nilgiris, Devarshola, Tea experimental station. Très nombreux exemplaires "in such prodigious numbers that the tea factory and its surroundings became heavily infested " (Mr. J. C. M. Pardner, *in litt.*, 1946).

L'espèce appartient au genre *Ballistura* (C. B.) Gisin—que je ne crois pas opportun d'adopter içi—et elle me semble très voisine de *P. fitchi* D. de Costa Rica. C'est pourquoi je la nomme *fitchioides*. En particulier, les chétotaxies dentales sont les mêmes dans les deux espèces, les bosses dentales se ressemblent et le tenaculum est toujours à 3 dents.

La nouvelle espèce se distingue avant tout par ses ergots et par certains rapports. Le tableau comparatif suivant permet et justifie la distinction.

Rapport M/Dm (Manubrium sur Dens plus mucron) : 1 (0·90) ; 5 (0·95) ; 5 (1·00) ; 1 (1·05) soit de 0·9–1·05 contre : 1 (1·05) ; 1·1–1·35 chez *fitchi*.—Rapport D/m : 2 (2·95) ; 3 (3·00) ; 5 (3·10) ; 5 (3·20) ; 1 (3·30) ; 3 (3·40) ; 1 (3·50) ; 1 (3·60) ; 1 (3·70), soit de 2·95 à 3·70 tandis que chez *fitchi* la variation s'étendait entre 2·65 et 3·20. En somme, le mucro-dens est plus long chez la nouvelle espèce que chez l'ancienne relativement au manubrium tandis qu'on ne peut tirer d'indication valable du rapport Dens/mucron.

Si la formule dentale est la même dans les deux espèces, il y a des différences dans la position des soies dorsales. Dans la nouvelle espèce les deux soies dorsales distales sont séparées du groupe des dorsales proximales par un espace très appréciable ; rien de tel chez *fitchi*.

Rapport m/P (mucron sur postantennal) : 1 (1·80) ; 9 (1·90) ; 8 (2·00) ; 3 (2·10) ; 3 (2·20) ; 1 (3·30) et 2 (2·35). On avait, chez *fitchi*, une variation entre 1·15 et 1·80. Ainsi le caractère est pratiquement bon.—Rapport P/ae3 : 1 (1·20) ; 10 (1·30) ; 4 (1·40) ; 3 (1·45) tandis qu'on a, chez *fitchi*, une variation de 1·15 à 1·55. Le caractère est donc inutilisable.—Rapport m/g3 : 1 (1·55) ; 9 (1·65) ; 5 (1·75) ; 6 (1·85) ; 1 (1·90). On avait, chez *fitchi*, une variation de 0·95 à 1·20. Le caractère est donc excellent. Ajoutons les rapports suivants : g1/ae1 : de 1·65–2·00.—E1/g1 : de 1·00–1·30. g3/ae3 : de 1·30–1·70. E3/g3 : de 1·05–1·35. Ainsi les ergots sont toujours au moins aussi longs que la griffe et généralement nettement plus longs (griffe mesurée le long de la crête interne). Leur épaisseur, leur dilatation apicale les distinguent facilement de ceux de *P. fitchi*.

Proisotoma nilgiris sp. n. (figs. 6–10).

Taille : 1·25–1·50 mm. Aspect habituel des espèces du genre. Coloration noire, par taches presque confluentes, avec régions intersegmentales claires, antennes colorées, pattes un peu teintées et furca claire. Soies de revêtement simples, courtes, devenant un peu plus longues sur l'arrière, particulièrement sur abd. 5 et 6 ; ces deux segments bien séparés. 8 yeux subégaux par côté ; organe postantennaire du même ordre de longueur que l'appendice empodial de p. 3 (fig. 6). Antennes relativement assez longues (*cf. inf.*) et toujours plus longues que la diagonale de la tête. Org. ant. III : *cf.* fig. 7 : cette disposition nous a paru très fréquente. Ant. IV long. Le nombre exact de soies olfactives n'a pas été déterminé, mais, généralement, 5–10 soies olfactives sont reconnaissables sur ledit article. L'une d'elles, sur la face externe, vers la moitié de la longueur de l'article, est nettement plus longue et plus forte que les autres ; nous l'avons toujours retrouvée sur 38 exemplaires étudiés. Tibia III/I : de 1·3–1·5. Un subsegment distal incomplet existe à tous les tibias. A toutes les pattes on a 3 ergots, très caractéristiques, longs, très nettement dilatés en spatule à l'apex, le médian des trois étant un peu plus long que les deux latéraux. Griffes (fig. 8) pratiquement sans dents latérales (rares vestiges ?) et toujours avec une belle dent interne. Appendice empodial non effilé et sans denticule. Tenaculum toujours nettement à 4 dents et muni d'une soie simple au corpus. Manubrium sans soies ventrales. Rapport Dm/Tib. 3 variant de 1·4 à 1·8 avec mode vers 1·5. Le mucro-dens est donc toujours très nettement plus long que le tibia de la troisième paire. Chétotaxie dentale paraissant très constante (fig. 9) et représentable comme suit :

Soies dorsales. *a*) basales, en partant de la base : 4, 1, 3.—*b*) distales, en partant de l'apex : externes : e1, e2 ; médianes : d1, d2, d3 ; internes : i1, i2. Soies ventrales, dans la moitié distale : externes : ve1, ve2 ; médianes : v1, v2, v3 ; internes : vi1.

La face dorsale de la dens montre des boursouflures irrégulières. Mucron (fig. 10) à lamelles assez basses et corps renflé dorsalement, à deux dents dont l'apicale est crochue et avec (toujours ?) une sinuosité vers le dehors entre les deux dents.

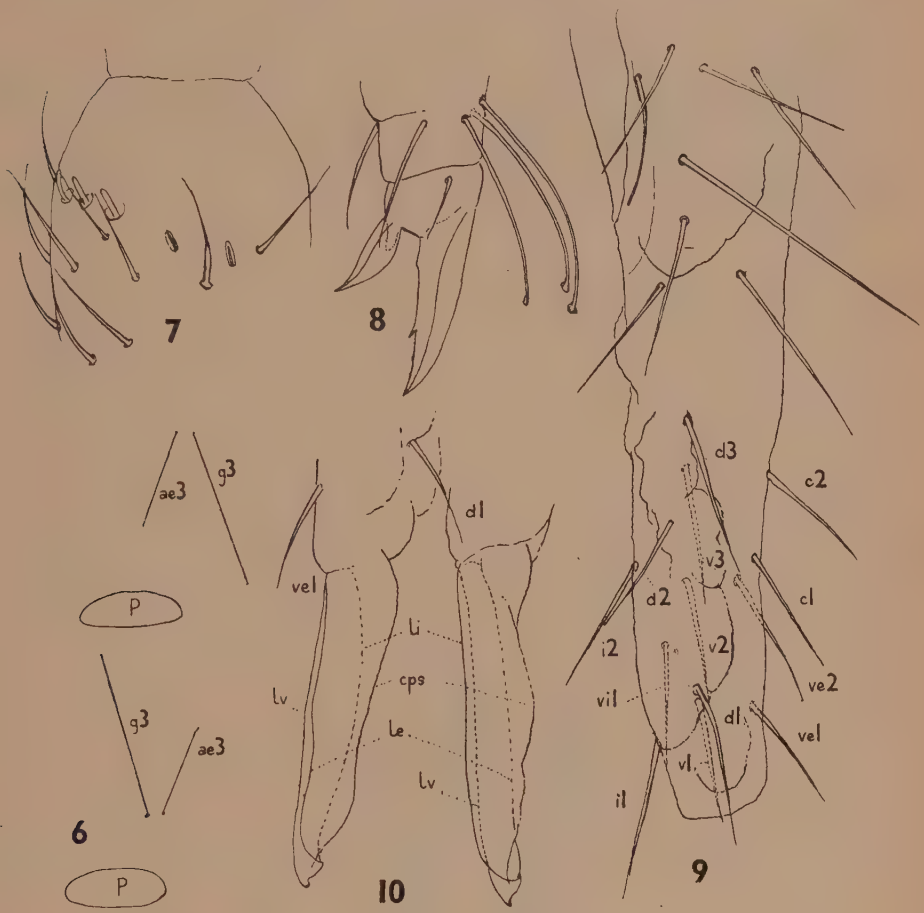

FIG. 6–10. *Proisotoma nilgiris* sp. n. 6, postantennal et g3 des mêmes individus, vus à la même échelle ; 7, org. ant. III ; 8, g3 ; 9, dens droite, face dorsale, soies ventrales vues par transparence ; 10, mucrons.

Rapport Ant./Diag. céph. : 1·05 ; 1·10 ; 5 (1·20) ; 9 (1·30) ; 3 (1·40).—Rapport Ant. IV/III : 2 (1·65) ; 3 (1·75) ; 9 (1·85) ; 9 (1·95) ; 4 (2·05) ; 5 (2·15).—Ant. III/II : 15 (0·9) ; 18 (1·0) ; 2 (1·05).—Rapport M/Dm (Manubrium sur dens plus mucron): 7 (0·90) ; 12 (0·95) ; 2 (1·00).—Rapport D/m : 2 (2·3) ; 13 (2·4) ; 25 (2·5) ; 15 (2·6) ; 8 (2·7) ; 3 (2·8) ; 1 (2·90) ; 1 (2·95).—Rapport g1/ae1 : 1 (1·55 ; anormal) ; 3 (1·9) ; 10 (2·0) ; 2 (2·1).—Rapport E1/g1 : 1 (1·2) ; 7 (1·3) ; 7 (1·4) ; 1 (1·5) ; 1 (1·55 : anormal). Rapport g3/ae3 : 1 (1·5) ; 6 (1·6) ; 23 (1·7) ; 10 (1·8) ; 5 (1·9).—Rapport E3/g3 : 1 (1·3) ;

24 (1·4) ; 6 (1·5) ; 1 (1·6).—Rapport m/P (mucron sur postantennal) : 2 (2·9) ; 6 (3·0) ; 10 (3·1) ; 6 (3·2) ; 10 (3·3) ; 5 (3·4) ; 11 (3·5) ; 6 (3·6) ; 8 (3·7) ; 6 (3·8) ; 1 (3·95) ; 1 (4·1). Rapport P/ae3 : 1 (0·75) ; 1 (0·80) ; 6 (0·85) ; 8 (0·90) ; 15 (0·95) ; 10 (1·00) ; 6 (1·05) ; 2 (1·10) ;3 (1·20). Rapport m/g3 : 2 (1·7) ; 6 (1·8) ; 25 (1·9) ; 21 (2·0) ; 9 (2·1) ; 4 (2·2).

India : Nilgiris, Devarshola, Tea experimental station. Très nombreux exemplaires, dans les mêmes conditions que les précédents. Les deux espèces ne sont pas mélangées dans les deux tubes qui m'ont été confiés.

Caractérisée avant tout par ses ergots, cette espèce ne peut—au tant que je sache—se confondre avec aucune autre. Je renvoie donc, pour sa justification, au tableau de détermination donné par moi en 1931 (*Boll. Lab. Zool. Portici*, **25** : 69–170) et aussi à celui de Gisin, 1944, *Verh. naturf. Ges. Basel.* **55** : 1–130.

A NEW SPECIES OF *SYSTOECHUS* (DIPTERA: BOMBYLIIDAE), BRED FROM EGGS OF THE DESERT LOCUST

By H. Oldroyd, M.A., F.R.E.S.
(*British Museum (Natural History)*.)

A number of specimens bred by Dr. N. Hynes, Entomologist of the Department of Agriculture, Kenya, were submitted to me by the Director of the Anti-Locust Research Centre. These specimens, including the type, are deposited in the British Museum (Natural History).

Dr. Hynes has kindly supplied the drawing of the thorax of a male. (Fig. 1.)

Systoechus somali sp. n.

A well-defined species belonging to the group which have hyaline wings, the femora (♂) darkened on the basal half with dark hairs, and abdominal bristles in the female but not in the male. Seen in dorsal view the male is uniformly furry white, the female shows three longitudinal pale thoracic stripes, and transverse black bands on the abdominal segments.

It is distinguished from any species known to me by the colour of the facial hairs—entirely dark brown or black in the male, uniformly white in the female—the dark brown pleural hairs of the male, and the entirely yellow leg bristles of both sexes. A nearly related species appears to be *S. xerophilus* Hesse, from S. Africa, which is a parasite of *Locustana pardalina* Walker. Other related species are *simplex* Loew, *chrystallinus* Bezzi, and *vulpinus* Becker.

Fig. 1.—*Systoechus somali* sp. n. Male thorax denuded of hairs.

♂. *Head.* Eyes separated at ocellar triangle by width of median ocellus. Frons with distinct median furrow, steel-blue in ground colour, with sparse grey tomentum and long dark brown hairs, which become thick on cheeks. Occiput with thick, long, rather bristly hairs which are mostly yellowish, with a sprinkling of brownish or black. Ocellar triangle with long black hairs. Antennae and proboscis black, with grey tomentum and black hairs.

Thorax. Metallic steel-blue in ground colour, except scutellum, which is more or less extensively orange on disc. Tomentum very thin, grey, and uniform, except for a narrow white median stripe. Hair long and moderately dense, uniformly white on dorsum, more yellowish towards anterior and lateral margins; pleural hairs chiefly dark brown, paler only on margins of sclerites and on metapleuron.

Abdomen. Metallic steel-blue in ground colour, extreme sides of segments 2, 3 obscurely orange, with thin grey tomentum. Dorsally with long, thick, silvery-white hair, ventrally with long, rather sparser dark brown hair. On the lateral margins are a few stiffer, somewhat bristly hairs, which are brown basally and paler apically, but there are no distinct bristles along the hind margins of the tergites.

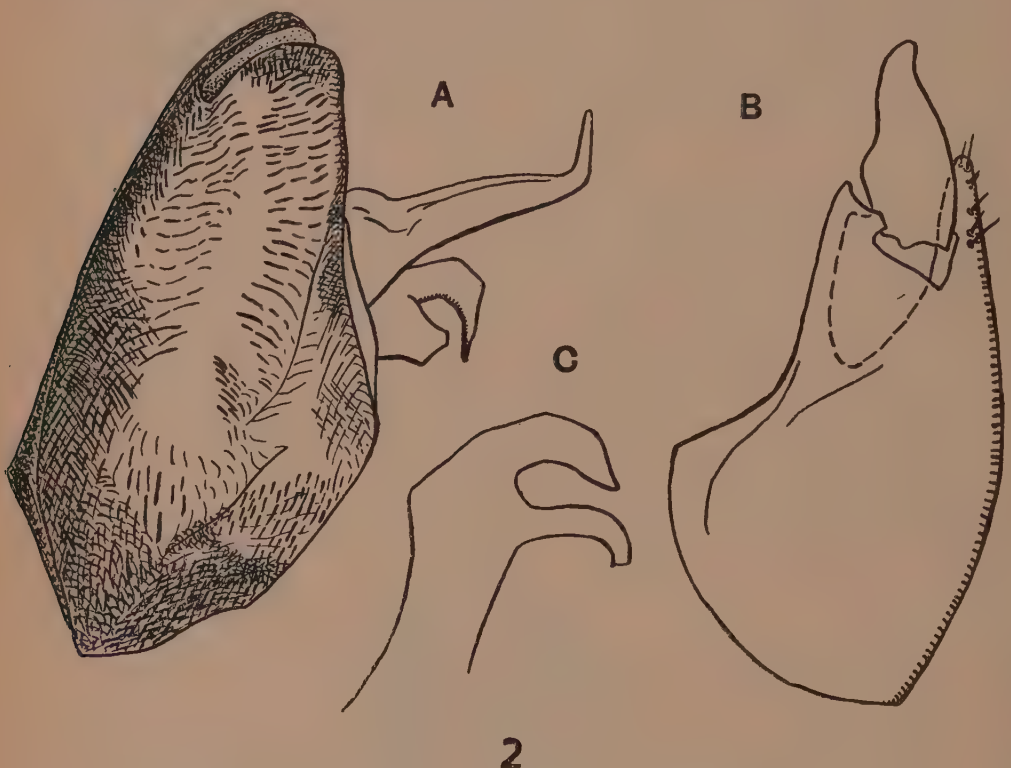

Fig. 2.—*Systoechus somali*, sp. n. Male genitalia: *A*, side view, beaked apical joint reflexed. *B*, left half of hypopygium in dorsal view. *C*, right lateral process of aedeagus. (Terms after Hesse, 1938.)

Legs. Coxae and basal half of femora blackish or dark brown, with long dark brown hairs. Rest of legs yellow, tarsal segments slightly darkened, clothed with short adpressed yellow hairs and yellow bristles. *Leg-bristles:* Femora—fore, none; middle, one anteroventral, one anterior preapical and one very small dorsal preapical; hind, five anteroventrals, two anterodorsals, one dorsal preapical, and three posteroventrals. Tibiae—fore, with three rows, and middle and hind with four rows of seven to ten bristles.

Wings. Entirely hyaline, veins yellowish. Base of costa with short black clothing hairs and a comb of long yellowish-white hairs and bristles, with a tuft of brown hairs on the tegula. Squamae with a white fringe.

♀ *Head.* Eyes separated at vertex by nearly three times width of ocellar triangle. Face and frons with thick ashy-grey tomentum. Frons with a shallow median furrow and an incomplete transverse furrow—above the latter and on ocellar triangle hairs are long, brown, below furrow and on face they are white. Beard and occipital hairs white. Antennae black, reddish on inner surface of second segment, with grey tomentum and white hairs.

Thorax. Steel-blue in ground colour, scutellum mainly orange. Mesonotum with a thick covering of ashy tomentum and three distinct grey longitudinal stripes. Long hairs all white on pleura, more yellowish on sides of mesonotum, where they are coarser and more bristly. On postalar callosities and on hind margin of scutellum distinct yellowish bristles.

Abdomen. Steel-blue in ground colour with greyish-brown tomentum. Long hairs white on venter, more yellowish on dorsum. Just before hind margin of each segment is a multiple row of very erect bristles which are brown at roots and fade to yellowish at tips—to the naked eye these give the abdomen a distinctly banded appearance, with traces of a median ongitudinal stripe.

Legs. Coxae concolorous with pleura, and with long, bristly, whitish hairs. Fore femora narrowly darkened at base, legs otherwise entirely yellow or orange, with adpressed whitish hairs and entirely yellow bristles, which are more robust than in the male. *Leg-bristles* : Femora—fore, none ; middle, two anteroventrals, one posteroventral ; hind, about seven anteroventrals, two anterior and one posterior dorsal preapical, and three posteroventrals. Tibae—fore with three rows, middle and hind with four rows of seven to ten bristles.

Wings. Entirely hyaline, with yellowish veins. Basal comb of yellowish-white bristles and hairs, tuft on tegulae also yellowish-white.

Length of body : 6-10 mm. ; *of wing :* 7–10 mm.

16♂ and 8♀. Somalia : Afdub, Wardere, 06° 50 N′. 45° 07′ E. Laboratory-reared larvae in diapause in old eggs of *Schistocerca gregaria* (Førskål). Collected 31st July, 1945, emerged on various dates from 27th August to 3rd November, 1945. I have seen two further females which are in very worn condition, but appear to belong to this species : one "caught projecting eggs into locust egg-holes," Kenya, Turkana, 23.v.45 ; the second from Kaputir, Turkana, Kenya, 22.v.45. (*D. L. Gunn.*)

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MEETINGS

TO BE HELD IN THE SOCIETY'S ROOMS

41, Queen's Gate, S.W.7

1947

WEDNESDAY, October 1, 15

" November 5, 19

" December 3

THE ROYAL ENTOMOLOGICAL SOCIETY OF LONDON

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